

THE TRANSIT OF VENUS.

A RARE AND INTERESTING PHENOMENON IN THE HEAVENS.

Successful Observations Made by the Government Astronomers to Determine the Earth's Distance From the Sun.

Hope and fear reigned alternately at the National observatory yesterday. The professors and assistant observers arrived early in the morning and gazed anxiously at long drifts of fleecy clouds which overspread the sky. There was nothing to do but to wait patiently. Everything had been done that was to be done in the way of preliminary arrangements. Out in the grounds Professor Harkness had placed his five-inch telescope in position and Mr. Rodgers had thoroughly tested the photographic apparatus. The great doors of the domes were open and the telescopes swung in position, waited to play their part in the observation of the transit of Venus across the disk of the sun.

The phenomenon was due, according to computation, at one minute past nine. About five minutes before this, however, Prof. Frisby, who had charge of the twenty-six-inch equatorial telescope, and who was gazing intently through the instrument, saw a very faint indentation in the clouds. It was at the exact point where he expected that the planet would appear. Another second, and a tiny black line cut the clear edge of the sun's disk. Another second, and the planet was fairly started upon its interesting journey across the face of the sun.

There are four contacts observed by astronomers, viz.: When the edge of the planet touches the outer limb of the sun; when it leaves the inner limb; when, in its egress, it touches the inner limb of the sun on the opposite side, and finally, when the last vestige of the planet disappears. The second contact was observed by Prof. Frisby about nineteen minutes after the first. The next contact was not due until the afternoon, and the mere passage of the planet across the sun, while interesting, was not absolutely important to observe.

It was within a few minutes of the time of the third contact when a *POST* reporter entered the dome where the large telescope is situated. Prof. Frisby and his assistant, Mr. George Anderson, were already at the instrument. Mr. Hall, son of Prof. Hall, stood before the astronomical clock, tablet in hand, waiting to record the time. The silence was only broken by the click of the pendulum motion of the machinery beneath the telescope. Through the glass the atmospheric disturbances, greatly magnified, made the edge of the sun bubble and boil like a great cauldron. "It is awful," said Prof. Frisby to his assistant, as he noticed this drawback to a perfect observation. A moment later and the canvas dome of the room echoed a sharp "Now!" The third contact had been noted.

A quarter, half, three-quarters of the planet passed off the sun's disk. Again Mr. Hall took his position before the clock. Again perfect silence.

"Lookout!"
"Ready," answered Mr. Hall.
"Mark one!"

"Right," was the laconic response.
"Gone!"

It was all over. The planet had disappeared again into space, and the "beauty spot" on the face of the sun was gone, the phenomenon of which a moment ago had interested the whole world, was destined not to be repeated until the year 2004.

Apart from the scientific value of the transits of Venus in determining by parallax the distance of the earth from the sun, there are other side issues, so to speak, of equal interest, dependent upon the phenomena. During the transit of Venus over the sun's disk in 1761 and 1759, a sort of penumbral light was observed around the planet by several astronomers, which was thought to indicate an atmosphere. This appearance was particularly observable while the planet was coming on and going off the solar disk. The total immersion and emersion did not seem instantaneous; but as two drops of water when about to separate form a ligament between them, so there seemed to be a dark shade stretched out between Venus and the sun, and when this apparent ligament broke the planet seemed to have got about an eighth part of her diameter from the limb of the sun. This phenomenon is popularly called by astronomers "the black drop," and volumes have been written upon it. Yesterday the planet was carefully observed by Prof. Frisby with especial reference to this apparent cohesion. He did not see it. On the contrary, the second contact was sharp and well defined. There was not the least bulging, and the circles of the planet and of the sun were as perfect as the most exacting geometrician could desire. Neither was it observed in the second contact by Commander Sampson, who used the five-inch glass in the old dome. The latter gentleman, however, said that he noticed it in the third contact, but not very marked. At the same time, he remarked that the appearance seemed to be dependent more on the state of the atmosphere than anything else. Prof. Frisby did not observe any apparent ligament at the third contact, although the atmospheric disturbances made the contact appear a little uncertain.

Another interesting observation was made just after the planet had begun its egress from the sun's face. As it emerged more and more into space there could be seen behind it a diffused white light, making its circular form distinctly visible. When half of the planet had emerged, the light, which was probably reflected from the sun, was no longer visible. This interesting sight was first observed through the large telescope by *THE POST* reporter, who called Professor Frisby's attention to it, and independently by Captain Sampson.

Observations were also made by Prof. Harkness through a five-inch glass, and by Mr. Roger through a three-inch glass. The latter also took fifty-three photographs of the sun during the day, not, however, during the contacts. The clouds interfered considerably with this part of the work, and good negatives were not obtained until about noon. During the opportunities offered by a clear sky photographs were taken at about an average of three a minute. In these photographs the sun's diameter is about four inches, and the planet appears as a black circle, about one-quarter of an inch in diameter.

The surface of the sun yesterday was almost free from spots. None of the observers, except Captain Sampson, saw any at all, and he only noted two. This was rather disappointing to some of the professors, who had hoped to be able to observe the curious sight of the passage of Venus across one of the spots. The astronomers here, however, were so much more successful than they had hoped to be, that this disappointment was not a matter of serious complaint. Had the state of the atmosphere been a little better, the observations could have been excellent. As it was, the success attending them was very fair, and they were looked upon as satisfactory under the circumstances.

The following figures show the observations reduced to Washington mean time. They are for the four contacts respectively:

PROF. EDGAR FRISBY.	CAPT. SAMPSON.
I.....2h. 58m. 4s.	I.....2h. 55m. 0s.
II.....2h. 58m. 4s.	II.....2h. 55m. 18s.
III.....2h. 58m. 57s.	III.....2h. 59m. 50s.
IV.....2h. 58m. 57s.	IV.....2h. 59m. 37s.

The discrepancies between these figures are due to the different personal equation of each observer and other causes. The last two of Prof. Frisby's were somewhat uncertain, owing to the flickering of the atmosphere, and the fourth one made by Capt. Sampson was about twenty seconds too early, as a cloud came up and obscured the planet before it entirely passed off.

Prof. Harkness observed two contacts and insign Brown three.

It is hardly necessary to go into detail as to the necessity for observing such phenomena as the transits of Mercury and Venus. They determine, primarily, by a geometrical method explained in all astronomical books, the distance of the earth from the sun. When this is obtained, beyond the shadow of a mathematical doubt, the astronomer will have a unit of celestial measurement by which the distances of the heavenly bodies can be accurately measured. The phenomena yesterday attracted general interest, and smoked glasses were in requisition. The planet was plainly visible as a black spot on the lower limb of the sun, and moved obliquely northwest.

In the observatory ground is a brick building bearing the inscription in gold letters, "Erected by the Transit of Venus Commission, 1876." Here are stored all the observations and records of the transit of December 8, 1874, and here also will be placed the observations and records made

yesterday. No practical solution of the problem of the solar distance as the result of the observations of the last transit has ever been published or ever will be. Long before the astronomers had completed their work they found that the results would not be scientifically accurate, and the transit of yesterday was awaited in order that additional, more general and more trustworthy observations might be made. Several years will probably elapse before these observations will be computed.

Only one telegram was received yesterday at the observatory. This was from Professor E. S. Holden, formerly connected with the institution here, but now in charge of an observatory at Madison, Wis. He said: "The first two contacts were satisfactorily observed by two observers. It is now noon and snowing hard."

It may be stated, as showing the relative position of the solar bodies yesterday, that the earth was 91,000,000 of miles from the sun and 24,000,000 million of miles from Venus. The latter planet was therefore 67,000,000 from the sun, or nearly three times nearer to the earth than to the sun.

At the United States signal office in this city observations of the times of contact in the transit of Venus were successfully made by Mr. Upton with an equatorial telescope of three inches aperture and magnifying power of seventy-five. At ingress the definition was good, but at egress the air was much disturbed, and clouds covered the sun at almost the exact instant of the final contact. The times of contact, as observed, were: First contact, 8h. 58m. 10s.; second contact, 9h. 10m. 3s.; third contact, 2h. 39m. 45s.; fourth contact, 2h. 59m. 29s. At ingress the "black drop" was very noticeable, and the whole outline of the planet was seen five minutes and twenty seconds before internal contact.

Mr. Winslow Upton, of the signal office, made a successful observation of the transit with a very fine three-inch telescope.